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ABSTRACT

Reported is a study to investigate teachers' patterns of belief related to attitudinal statements on teaching. In addition, the study investigated the relationship between teacher types as identified by their patterns of belief and certain background characteristics of those teachers. The research method employed and described in detail was the Q-methodology. The science teachers involved were from a mixture of rural and urban, junior and senior high schools, in a regional area. Data were collected from 67 teachers and analyzed using the QUANAL program. From the results and conclusions of data analysis, it was noted that three distinct science teacher types were identified. Overall Type I favored student-centered, indirect teaching behaviors. Type II favored open classroom communications along with strong discipline and small group activities. Type III favored large group activities, structure in their lessons, and flexibility and variety in classroom materials and techniques. The broad areas of behavior held most important by Type I teachers were indirectness and warmth; Type II, communication, knowledge and discipline; Type III, flexibility and communication. (EB)

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An Analysis of Science Teachers' Beliefs about Teacher Classroom Behaviors

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Objectives: The objectives of this research were to investigate teachers' patterns of belief related to attitudinal statements on teaching. The study was designed to examine the patterns of belief that exist among teachers, the attitudes about teaching most supported and least supported by the belief patterns, and the nature of the differences and the similarities in attitudes supported by those patterns. In addition, the study investigated the relationship between teacher types as identified by their patterns of belief and certain background characteristics of those teachers.

Methodology: This study employed Q-methodology and techniques to identify and analyze the belief patterns of teachers with respect to statements dealing with the behaviors of teachers. Q-methodology, as developed by Stephenson (1953), provides for the correlation and clustering of persons according to their rank-order sorting of objects. Q-technique, a set of procedures to implement Q-methodology, involves the sorting of decks of cards called Q-sorts by individuals and a statistical treatment of the different responses of individuals to the Q-sorts. This research study employed a forced sort format. The participants were asked to sort the items into a quasi-normal distribution on an eleven point scale ranging from most important to least important in relationship to their beliefs about teaching.

Instrumentation: The Q-sort instrument used in this study was developed in several steps. First a review of the literature dealing with research on teacher behaviors was conducted. From this review, eight categories describing types of teacher behaviors that have been systematically observed and reported were established. The eight categories include: warmth; indirectness; social system; discipline; knowledge; management; communication; and flexibility. Next, attitudinal statements relating to the variables identified were assimilated from the literature. This list was analyzed for redundancies and then submitted to a panel of educators to (1) determine if the items were clear and understandable; (2) determine if the items related to teacher behaviors and beliefs; (3) determine if the items could be assigned to only one of the categories previously identified; and (4) determine if within the framework of the study andy additional items or ideas needed consideration. In addition to the Q-sort instrument, a personal data questionnaire was administered to the participants.

Data and Its Sources: The science teachers involved were from a mixture of rural and urban, junior and senior high schools in a regional area. All teachers in the participating school systems were personally contacted for this study. Data was colledcte from 67 of the teachers. In addition to sorting the 80 behavioral items into a quasi-normal distribution on an eleven point scale ranging from most-important to least-important

in relationship to their beliefs about teaching, they supplied data pertaining to their specific background characteristics.

Statistical Procedures: The data was analyzed using the QUANAL program developed by N. Van Turbergen (1969) at The University of Iowa. It processed the data in the following manner.

1. A Pearson product-moment correlation matrix was produced by correlating each variable's items with every other variable's items.
2. The correlation matrix was evaluated for principal component factors.
3. The obtained factors were rotated according to a varimax (orthogonal) procedure.
4. The rotated factor matrix was reordered, classifying each variable according to its highest factor loading.
5. Each variable was assigned a weight by utilizing the following formula:

$$W = \frac{r}{1 - r^2}$$, where

W = weight, and r = highest factor loading

6. Each pattern of response item associated with each factor was estimated. This was done by weighting each item response of each of the variables most highly associated with a given factor, summing the weighted responses across each item for each factor, and then standardizing and converting to z-scores the

weighted item arrays for each factor.

7. The z-scores were then used to compare and differentiate the factor descriptions.

The degree of relationship between the personnel characteristics and the type of view as established by this study was investigated using Cramer's statistic, phi-prime. This statistic was used instead of the coefficient of contingency because it varies from zero to one and thereby permits comparison between the phi-primes of different sized contingency tables (Hays, 1963, p. 606).

Results and Conclusions: Three distinct science teacher types were identified through the study. All the behavioral categories in the instrument were important in characterizing and differentiating the three patterns of belief. Overall Type I science teachers favored student-centered indirect teaching behaviors. The two broad areas of behavior which they held to be the most important in the classroom were indirectness and warmth. These two categories were also considered more important by Type I than by either of the other two Types of science teachers. Type I science teachers believed behaviors related to the categories of discipline and management were of least importance for the classroom teacher. They also ranked the overall categories of communication and flexibility lower than did either of the other two Types.

Type II science teachers favored open classroom sommunications along with strong discipline and small group activities. The two broad categories of behavior which Type II held to be most important were communication and flexibility. The two categories of management and social system were of least importance for Type II teachers. Overall Type II teachers ranked the categories of communication, knowledge, and discipline higher than did either of the other two Types. They also ranked the categories of indirectness, social system, and management lower than did either of the other two Types of science teachers.

Type III science teachers favored large group activities, structure in their lessons, and flexibility and variety in classroom materials and techniques. The two broad categories of behavior which Type III science teachers held to be most important were flexibility and communication. These are the same categories Type II highly regarded although in the opposite order. Type III science teachers believed behaviors related to discipline and management were of least importance. Overall Type III teachers believed the categories of warmth and knowledge were of less importance and the categories of flexibility and social system were of more importance than did either of the other two Types of science teachers.

Overall background characteristics of the teachers were not found to be significantly associated with the three science teacher types.

Significance: This study helped define the underlying belief systems of science teachers. This information is important in helping to better plan pre-service teacher education programs. Biddle (1964, p.11) stated, "Prospective teachers can no longer be exposed to some facts about individual differences, some theories about learning, child growth, and development, and let the entire burden of translating this knowledge into teaching fall upon the student and the practice teaching experience." Teacher education personnel need to convey to pre-service students some knowledge about how classroom teachers have translated various attitudes assimilated from philosophy, history, sociology, psychology, and education classes into patterns of belief which influence their behaviors in the classroom. The pre-service teacher education student can use knowledge about differing teacher typologies to assess the usefulness of various opinions, beliefs, and attitudes about education and teacher behaviors, and more concretely construct their own ideal teacher image. Thus the information gained from this study should enable teacher educators to more effectively help students develop their own patterns of belief about teaching.

CATEGORY RANKING BY TYPES

Category	Ranking		
	Type I	Type II	Type III
Indirectness	1	5	4
Communication	3	1	2
Warmth	2	4	5
Flexibility	4	2	1
Knowledge	5	3	6
Social System	6	7	3
Management	7	8	7
Discipline	8	6	8

RE-ORDERED FACTOR MATRIX ROTATED THROUGH FACTOR SOLUTION

Factor	Variable	Factor Loading on Type	Commonality	Pure[1]
Factor 1				
N = 35	7	0.822	0.689	0.979
	54	0.711	0.518	0.976
	20	0.602	0.363	0.970
	8	0.825	0.706	0.964
	21	0.812	0.688	0.959
	36	0.829	0.736	0.934
	44	0.722	0.559	0.933
	15	0.736	0.588	0.922
	48	0.760	0.638	0.905
	9	0.677	0.513	0.894
	47	0.755	0.639	0.892
	64	0.286	0.093	0.874
	18	0.713	0.600	0.849
	62	0.580	0.407	0.827
	39	0.778	0.736	0.823
	46	0.601	0.440	0.820
	63	0.370	0.168	0.813
	52	0.659	0.535	0.811
	12	0.739	0.693	0.788
	1	0.515	0.337	0.787
	58	0.586	0.445	0.771
	4	0.708	0.686	0.732
	22	0.376	0.194	0.731
	10	0.613	0.532	0.707
	17	0.590	0.493	0.707
	28	0.468	0.331	0.661
	30	0.577	0.512	0.651
	40	0.414	0.283	0.606
	41	0.524	0.470	0.584
	45	0.464	0.391	0.550
	67	0.334	0.219	0.509
	6	0.529	0.556	0.502
	25	0.458	0.453	0.463
	57	0.488	0.526	0.454
	49	0.500	0.576	0.434
Factor 2				
N = 20	56	0.710	0.506	0.997
	19	0.618	0.392	0.974

Factor	Variable	Factor Loading on Type	Commonality	Pure[1]
	3	0.624	0.413	0.943
	31	0.670	0.478	0.938
	14	0.650	0.454	0.930
	27	0.678	0.550	0.837
	23	0.701	0.598	0.821
	66	0.584	0.420	0.812
	33	0.516	0.351	0.759
	34	0.440	0.271	0.713
	53	0.353	0.193	0.646
	26	0.487	0.378	0.627
	65	0.349	0.202	0.603
	61	0.523	0.456	0.600
	43	0.549	0.591	0.509
	24	0.451	0.403	0.504
	5	0.462	0.433	0.492
	35	0.441	0.396	0.492
	38	0.471	0.488	0.454
	37	0.411	0.489	0.345
Factor 3				
N = 12	13	0.768	0.598	0.986
	32	0.728	0.544	0.976
	16	0.645	0.462	0.901
	42	0.342	0.158	0.743
	2	0.477	0.321	0.709
	55	0.446	0.296	0.672
	11	0.653	0.716	0.595
	50	0.455	0.385	0.537
	29	0.564	0.706	0.451
	51	0.426	0.431	0.422
	59	0.400	0.402	0.399
	60	0.429	0.506	0.365
Eigenvalues		23.4689	4.4318	3.4141

[1] $\text{Purity} = \frac{(\text{Factor Loading})^2}{\text{Commonality}}$

TYPE--PERSONAL CHARACTERISTIC PHI-PRIMES

Personal Characteristic	Phi-Prime
Sex	0.05
Age	0.17
Years of Teaching Experience	0.11
Years in Present School System	0.21
Grade Level	0.21
Subject Taught	0.17
Formal Education	0.13
Institutions Granting Degrees	0.39
School Community	0.28
School Size	0.20

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